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ROLE OF MRI IN EVALUATION OF ROTATOR CUFF PATHOLOGIES ASSOCIATED WITH ACROMION MORPHOLOGY AND BICEPS (LONG HEAD) PATHOLOGY.

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ABSTRACT

Objectives: Our aim is to study the rotator cuff pathologies and association of rotator cuff pathologies with acromion morphology and biceps (long head) pathologies.

Materials and Methods: In this prospective study, 40 patients clinically suspected of rotator cuff pathologies were evaluated using 1.5 tesla Siemens MRI machine using the required protocol and sequences for the rotator cuff tendon tears/tendinosis and associated acromion morphology and biceps tendon(long head) pathologies over a period of 12 months (August 2019 - August 2020)

Results: The average age of the patients was 42.7 years with male dominance (86%). Out of the 40 patients, supraspinatus was the most common pathological tendon with 70% cases showing abnormalities. The rotator cuff tears were more common in the later age groups and tendinosis more common in the early age groups. Partial tears of rotator cuff were more common than complete tears.56% cases showed partial tears in supraspinatus as compared to 13% cases of complete tears. Articular surface tears were most common partial tears seen in 45% cases. Variation in the acromion morphology (especially type 2) and Biceps(long head) pathologies showed positive correlation with the rotator cuff pathologies.

Conclusion: MRI due to its superior ability to demonstrate soft tissue structures together with its noninvasiveness nature has made it the imaging modality of choice to diagnose and characterise the rotator cuff and associated pathologies.

KEYWORDS : MRI, Rotator cuff, acromion, biceps, supraspinatus.

INTRODUCTION:

The glenohumeral joint is a ball-and-socket type of synovial joint where humeral head articulates with the glenoid cavity of the scapula[1]. The articular surface of the humeral head is larger as compared to the glenoid fossa which is a primary cause of instability in this joint[2].The joint stability is provided by two set of the stabilizers – passive and active[3]. Rotator cuff is an important active stabilizer of the glenohumeral joint. Rotator cuff consists of four muscles and their tendons, namely, supraspinatus, infraspinatus, subscapularis, and teres minor. It is predisposed to a variety of the external and internal stress factors. The external factors include trauma, and internal factors on the other hand include primary impingement due to overlying acromion and acromioclavicular joint hypertrophy and secondary impingement due to glenohumeral joint instability[4]. There is another intrinsic theory of the rotator cuff pathology which explains intrinsic degeneration as the primary cause of the rotator cuff tears[5]. Rotator cuff pathologies can be evaluated with the secondary changes in the biceps tendon (long head).

Magnetic resonance imaging (MRI) plays an important role in the evaluation of the rotator cuff pathologies. MRI provides good spatial resolution together with the multiplanar imaging which allows evaluation of the fine details associated with rotator cuff. Its accuracy is comparable to the ultrasound in diagnosis of the rotator cuff lesions; however, it is not operator dependent like sonography[6]. Its superior ability to demonstrate soft tissue structures together with its noninvasiveness nature has made it the imaging modality of choice to evaluate the rotator cuff[7].

AIM OF THE STUDY:

Our aim is to study the rotator cuff pathologies and association of rotator cuff pathologies with acromion morphology and biceps (long head) pathologies.

MATERIALS AND METHODS:

In this prospective study, 40 patients clinically suspected of rotator cuff pathologies were evaluated using 1.5 tesla Siemens MRI machine using the required protocol and sequences for the rotator cuff tendon tears/tendinosis and associated acromion morphology and biceps tendon(long head) pathologies over a period of 12 months(August 2019 - August 2020)

MRI technique

The patient was made to lie in a supine position with the head end toward the scanner bore. The patient's arm was placed to the side of the patient and in external rotation. The MRI scanning protocol included imaging in the axial, coronal oblique, and sagittal oblique.

Image interpretation was done for the rotator cuff tears, tendinosis, acromion morphology, and biceps tendon pathologies. Partial tears were seen as the focal area of increased signal intensity on PD fatsat and T2 fatsat images with partial tendon disruption. Complete tears are seen as full-thickness tendon breach with increased signal intensity on PD fatsat and T2WI. Tendinosis is seen as focal increased signal intensity on PD fatsat images withouttendon breach. Acromion can be divided into four types depending on the undersurface morphology – Type I with flat, Type II with concave, Type III with hooked, and Type IV with convex undersurface. Biceps tendon was evaluated for tenosynovitis, tendinitis, and tendon tears.

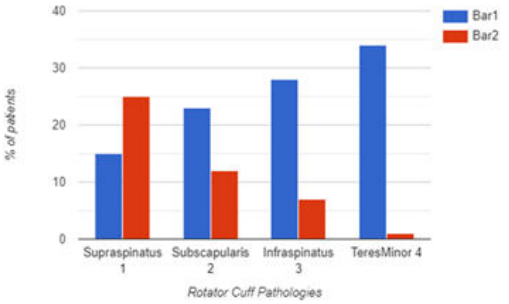
OBSERVATIONS AND RESULTS:

The study was carried out in a sample size of 40 patients comprising 32 males and 8 females. The most common tendon involved was supraspinatus showing abnormalities in 70 % cases [Graph 1]. The age distribution of the rotator cuff pathologies was further assessed. The tears of the rotator cuff were more common in the later age groups; however, the tendinosis was more common in the younger patients. For supraspinatus tendon, 70% of the cases of the tendinosis occurred before the age of 45 years and 65% of the tears (partial and complete) occurred after the age of 45 years. A similar trend was seen for other rotator cuff tendons.

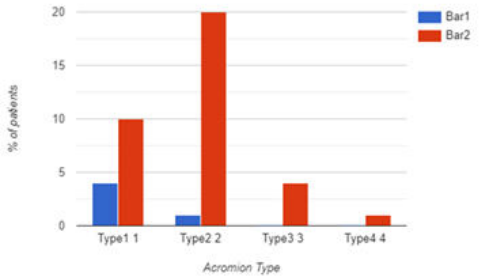
In our study, partial tears of rotator cuff were more common than the complete tears. Partial and complete tears were seen in 56% and 13% cases, respectively, for supraspinatus. A similar trend was seen in the other tendons of the rotator cuff. Among the partial tears of the supraspinatus, articular surface tears were most common and seen in 45% cases.

Acromion morphology assessed in relation to the rotator cuff tears. Type II acromion most commonly seen in the study, occurring in 57% of cases. The variation in the acromion morphology showed a positive correlation with the rotator cuff pathologies ($P < 0.05$). Biceps (long

head) tendon showed pathologies in 65% of the evaluated cases. Biceps pathologies showed positive correlation with the rotator cuff injuries ($P < 0.05$) [Table 1].



Graph 1: :Distribution of rotator cuff injuries



Graph 2: Rotator cuff pathologies and acromion morphology correlation

Table 1: Rotator cuff pathologies and biceps tendon (long head) pathologies correlation table:

ROTATOR CUFF TENDON	BICEPS TENDON		CHI SQUARE	
	NORMAL	ABNORMAL	X^2	P
NORMAL (n = 5)	4	1	5.1	0.02 (S) P< 0.05
ABNORMAL (n=35) Tears + tendinosis	10	25		
TOTAL	14	26		

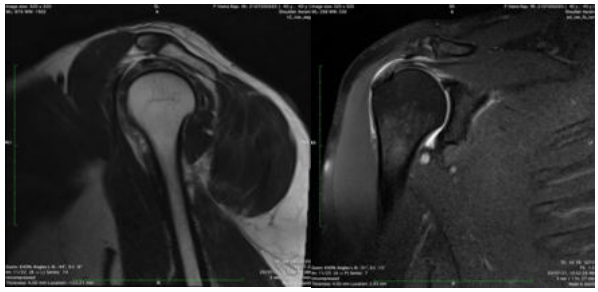


Fig 1:MRI T2 saggital and PD fatsat coronal images of shoulder joint showing type 2 acromion with partial tear of supraspinatus tendon

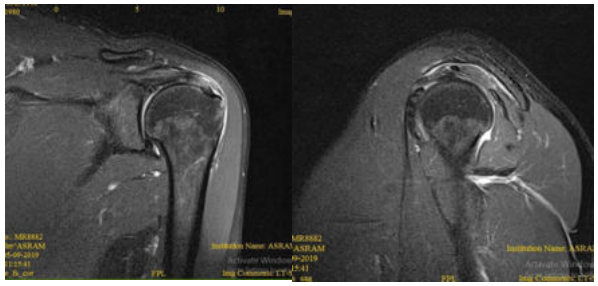


Fig 2: MRI Coronal and Saggital proton density fat saturated images of shoulder joint showing partial supraspinatus tear associated with type III acromion process.

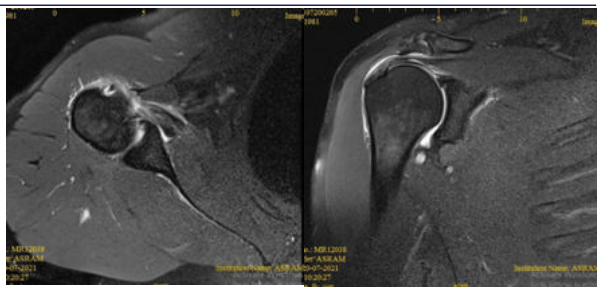


Fig 3: MRI axial and coronal PD fat sat. images of shoulder showing biceps long head tendon tenosynovitis, partial thickness tear of subscapularis and intrasubstance supraspinatus tear.

DISCUSSION:

MRI is a sensitive modality for the evaluation of the rotator cuff pathologies and has important implications in the further management of the rotator cuff pathologies. With the advent of the surface coils, the MRI has been widely used for the evaluation of the rotator cuff pathologies such as tears and tendinosis.

Our study included 40 patients clinically suspected of rotator cuff pathologies. The supraspinatus tendon showed abnormalities in the maximum number of cases (70%), followed by subscapularis tendon and infraspinatus. Garavaglia*et al*.[8] in a retrospective study of 348 patients comparing MRI and arthroscopy findings found supraspinatus tears in cases with none of the rotator cuff tears occurring without supraspinatus involvement.

Rotator cuff pathologies were further classified into tendinosis, partial tear, and complete tears. The incidence of the rotator cuff tears increased with age; however, tendinosis occurred in younger patients. The 65% of tears in supraspinatus, 72% tears in subscapularis, and 78% tears of infraspinatus occurred after the age of 45 years. 70% cases of supraspinatus tendinosis occurred before the age of 45 years. Similar trend has been found in the previous studies. Needell *et al*.[9] in a study of 100 patients found 20 out of the 22 partial tears and all complete tears occurred after age of 40 years. Tendinosis was more commonly seen in the younger population. Similar results were seen by Yamaguchi *et al*.[10] and Minagawa *et al*.[11] Different reasons have been given for the increase in the incidence of tears with age. Impingement secondary to the extrinsic factors such as osteophytes, downsloping acromion, and Type II and III acromion increases with age. Similarly, internal degeneration in the tendons increases with age.

Partial tear of supraspinatus tendon can be further divided into articular surface, bursal surface, or intrasubstance tears. Articular surface partial tears have been more commonly seen in the previous studies. Jacobson *et al*.[12] in a study of 50 cases with rotator cuff tears with surgical correlation reported 10 cases of articular surface tears out of the total 15 partial tears. Similar results were reported by Youssef *et al*.[13] and Winter *et al*.[14] The common reason given for the high incidence of the articular surface tear is comparative hypovascularity seen on the articular surface of tendon as compared to the bursal surface.

Acromion has been traditionally divided into four types according to undersurface morphology. Type II acromion has been cited as most common form in the majority of the literature. Getz *et al*.[15] in a study of 394 scapulae found Type II acromion in 68.5% cases and Type I in 22.8% cases. In our study, Type II acromion morphology was most commonly encountered seen in 57% cases. Variation on the acromion morphology has been associated with the rotator cuff tears, especially Type II and Type III acromion. Worland *et al*.[16] in a study carried in 118 patients with suspected rotator cuff tears found that Type II and III acromion are more commonly associated with the rotator cuff tears. Our study showed similar results. Majority of the rotator cuff pathologies was associated with Type II and Type III acromion. 90% cases with Type II acromion and all cases with Type III acromion showed rotator cuff pathologies.

Biceps (long head) tendon showed abnormalities in 65% of the evaluated cases with tenosynovitis being the most common pathology seen in 40% cases. Rotator cuff pathologies showed positive correlation with the biceps tendon pathologies. In 35 cases of rotator cuff abnormalities, 25 cases showed biceps pathologies ($P < 0.05$).

Chen *et al*.[17] in a study of 176 patients of rotator cuff pathologies found that among the single tendon rotator cuff tears, the incidence of biceps tendon pathology was seen in the 71% cases ($P < 0.001$). The incidence increased when multiple tendons were involved. Similarly, Beall *et al*.[18] found that tears of long head of the biceps tendon showed positive correlation with the supraspinatus and subscapularis tendon tears.

CONCLUSION:

MRI is an accurate and sensitive modality to diagnose and characterize the rotator cuff pathologies. It provides accurate view of the associated findings such as acromion morphology and biceps pathologies and can be helpful in the future management of the rotator cuff pathologies.

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